PATENT SPECIFICATION

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(72) Inventor BRYANT EDWARDS

(19)

(54) NESTABLE ARTICLES

(71) We, ILLINOIS TOOL WORKS INC., a Corporation organized under the laws of the State of Delaware, United States of America, of 8501 West Higgins Road, Chicago, Illinois 60631, United States of America, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

We are familiar with the problem of handling nestable or stackable type articles, as evidenced by patents which have heretofore been granted to us. Thus, for example, our British Patent No. 865024, covering improvements in nestable thin-walled plastics cups, has found extensive commercial acceptance in instances where such cups are to be shipped or vended in stacked relation. Pertinent prior art containers have generally used reverse taper in a wall of the container or have relied upon accidental rotational mis-alignment of adjacent cups in a stack to prevent such thin-walled containers from jamming or wedging in transport or handling. The present invention, without requiring the use of reverse taper, provides a wall configuration which ensures rotational mis-alignment of adjacent articles in a stack.

More specifically, the present invention contemplates a unique and very practical arrangement whereby articles, as for example thin-walled plastics cups, may be telescopically associated or nested without the potential hazard of wedging or jamming.

It is an object of the present invention to provide a nestable type article of the type referred to above in which the novel structural characteristics are such that, in order to effect complete nesting of one article within another, a predetermined relative rotational relationship between said articles is necessitated.

The present invention further contemplates an improved and highly practical nestable article, e.g. a cup, of the type set forth above, wherein the aforesaid relative rotation is automatically effected by a novel arrangement of cam or guiding surfaces.

The present invention contemplates nestable articles of the type referred to above, wherein a unique stacking section is incorporated in the article which may be positioned at the top of the article, in the bottom of the article or intermediate the top and bottom of the article in the side wall.

It is also an important object of the present invention to provide a uniquely designed "non-jammable" nestable article which may be produced by the practice of available moulding or forming methods. Examples of such articles are bottle caps and other covers. Examples of materials other than plastics are metal foils, paper and composite materials.

According to the present invention, a nestable article is a one-piece article capable of substantially surrounding an identical article in a nested relation which is determined by stacking means of each article, and in which the article is offset downwards along an axis relatively to the other article, the stacking means of the article comprising a first stacking section and a second stacking section, each section extending around the said axis, and the sections being spaced apart downward along the axis by the remainder of the stacking means, the first section comprising a continuous circumferential series of abutments, each defined by a converging pair of abutment surfaces oppositely inclined to the downward direction of the axis, and the second section comprising a continuous circumferential series of recesses each defined by a converging pair of recess surfaces oppositely inclined to the downward direction of the axis, the abutment surfaces and the recess surfaces forming respective complementary circumferential undulations, and the recesses being capable of making supporting engagement with the abutments of another, identical, article nested

therewithin so as to maintain the articles free from binding engagement with each other when in nested relation.

Several embodiments of the present invention will now be described, with reference to the accompanying drawings, in which:—

Figure 1 is a side elevational view of an article in the form of a container embodying the present invention;

Figure 2 shows the article of Figure 1, viewed from the underside;

Figure 3 is a fragmentary enlarged vertical sectional view of a lower portion of the container, taken substantially along the line 3—3 of Figure 2;

Figure 4 is also an enlarged fragmentary vertical sectional view of the lower portion of the container, taken substantially along the line 4—4 of Figure 2;

Figure 5 is a fragmentary vertical sectional view disclosing the portion of the container illustrated in Figure 3 nested within the portion of the container illustrated in Figure 4;

Figure 6 is a fragmentary perspective view disclosing a section of the bottom periphery of the container of Figure 1;

Figure 7 is a detailed vertical sectional view, taken substantially along the line 7—7 of Figure 5, more clearly to illustrate the manner in which the lower external stacking section or abutment of one container nests within the internal upper stacking section or recess of a companion container;

Figure 8 diagrammatically illustrates in three steps designated by the letters A, B and C, the progressive camming or guiding action which causes relative rotation between telescopically associated containers as they move automatically into complete nesting relation;

Figure 8A is a fragmentary vertical sectional view similar to Figure 3 and discloses a modified bottom portion;

Figure 9 is an elevational view of a second article, in the form of a container having a stacking section located at its upper extremity;

Figure 10 is a fragmentary, central vertical sectional view of the container disclosed in Figure 9 having associated therewith a like container illustrated in dotted lines, said containers being disclosed in partial telescopic association;

Figure 11 is an enlarged fragmentary sectional view taken substantially along the line 11—11 of Figure 9;

Figure 12 is a fragmentary perspective view of the stacking section illustrated in Figure 11;

Figure 13 is an elevational view of a third article, in the form of a container having a stacking section located intermediate the upper and lower extremities of the container, a like container shown by dotted lines being illustrated in partial telescopic association therewith;

Figure 14 is a fragmentary central vertical sectional view of the upper portion of the container shown in Figure 13;

Figure 15 is an elevational view of a fourth article, in the form of a container having a stacking section located in its bottom;

Figure 16 is a fragmentary central vertical sectional view of the bottom portion of the container shown in Figure 15;

Figure 17 discloses a plurality of stacked cover elements for incapsulating the upper extremity of a bottle and having a stacking section constructed in accordance with the teachings of the present invention; and

Figure 18 discloses one of the stacked cover members of Figure 17 crimped in position upon the upper extremity of a bottleneck.

Referring now to the drawings more in detail, wherein like numerals have been employed to designate similar parts throughout the various views, Figure 1 discloses a side elevational view of a thin-walled plastics container designated generally by the numeral 10, said container at its lower extremity being provided with circumferential stacking means designated generally by the numeral 12. A wall 14 of the container 10 diverges generally upwardly and outwardly to an upper rim 16 defining the open end of the container.

In the disclosed embodiment, the stacking means 12 is positioned at the lower extremity of the container and has an overall vertical extent indicated by the bracket 18 in Figure 1. The lower external section of the stacking means 12 comprises a plurality of circumferentially distributed, triangular-shaped abutment surfaces 20 which diverge upwardly in pairs from bottom radial lines of intersection 22. The surfaces 20 are joined at their radially inner edges to wall portions 24.

The upper internal section of the stacking means 12 comprises a plurality of pairs of generally trapezoidal internal recess surfaces 26, which converge downwardly and extend inwardly from the inner surface of the wall 14 of the container. The recess surfaces 26 of each pair intersect along a radial line 25 at their lower ends, and the extreme upper end of adjacent pairs intersect on the radial line 27. Pairs of the converging recess surfaces 26 define recesses for interlockingly accommodating complementary pairs of external abutment surfaces 20 of a like container. These pairs of internal recess surfaces 26 extend inwardly from the inner

surface of the wall 14 and define a series of circumferentially positioned, downwardly and radially extending recesses spaced upwardly from and circumferentially offset from the aforesaid pairs of abutment surfaces 20 of the lower external section. Thus, as illustrated in Figure 7, when like containers are in completely nested relation the recess defined by each of the pairs of internal recess surfaces 26 serves to accommodate the complementary upwardly diverging pair of abutment surfaces 20 of the lower external section. In other words, the recess surfaces 26 of one container at the line 25 serve as a support for the line 22 between the lower abutment surfaces 20 of the other container.

It will also be apparent from the foregoing description that, in a stack of nested containers, each pair of upwardly diverging abutment surfaces 20 is in vertical alignment with a complementary pair of the downwardly converging recess surfaces 26.

In each container a rib 28 extends upwardly from the radially outward end of line 22 to the radially inner end of line 27. If desired the ribs 28 may be inclined upwardly and inwardly to produce a longer line 27 for more positive guiding in the stacking operation of complementary containers. Further, in each container, a rib 29 extends upwardly from the upper end of wall portion 24 to the radially inner end of the line 25. The ribs 29 and 28 are interconnected through obvious wall portions 31 producing a fluted configuration circumferentially of the container. In conjunction with this construction the outer peripheral extremities of the diverging abutment surfaces 20 terminate within a concentric circle of the container 10 having a diameter not in excess of and preferably slightly less than the internal diameter of the container sidewall surface adjacent the line of intersection 25 of recess surfaces 26, and further having a diameter greater than the diameter of a circle defined by the radially inward ends of the lines 27. From the disclosure in Figure 5, it will be apparent that there is no contact of the ribs 28 of the stacking means 12 with the inner surface of the container wall 14. Each pair of external abutment surfaces 20 engages and interacts with a portion of a complementary pair of internal recess surfaces 26, in such a manner as to assure a complete and concentric nesting in a stack.

The abutment surfaces 20 and the recess surfaces 26 function as cam or guiding surfaces in effecting the complete nesting of containers 10. This camming feature is diagrammatically illustrated in Figure 8. The lower external section of the stacking means 12 is illustrated by solid lines and the upper internal section of said stacking means is represented by dot-and-dash lines. It will be apparent that the abutment surfaces 20 and the recess surfaces 26 are all inclined to the vertical, that is to the axial direction of nesting of one container with another identical container. In the diameter A of Figure 8, the lower horizontal lines of intersection 22 of the surfaces 20 are shown in contact with the upper line 27 between adjacent recess surfaces 26. Obviously, because of the line to line contact the upper container will not remain in this position but will be rotatably guided either to the left or to the right. In the diagram B of Figure 8, the upper container is shown as initially shifting to the right, due to the camming coaction of the above-mentioned abutment and recess surfaces. In the diagram C, the upper container is illustrated as approaching its final position of complete nesting.

From the inner ends of lines 27, the recess surfaces 26 extend downwardly and inwardly to ribs 29. From the outer end of line 22, the abutment surfaces 20 extend upwardly and inwardly to ribs 29. From the foregoing description of the inclinations of the abutment surfaces 20 and recess surfaces 26, it will be apparent that the necessary circumferential offset of those surfaces is accomplished. Thus, the abutment surfaces 20 recess surfaces 26 cooperate as cams in effective relative rotation between telescopically associated containers, thereby assuring automatic engagement of the abutment surfaces 20 with the recess surfaces 26. In the final position of nesting, the containers are secured against further relative rotation and are also concentrically nested with sufficient clearance between the inner surface of the wall 14 and the ribs 28 to preclude any possibility of jamming (see Figure 5).

In the disclosed embodiment, the included angle of each pair of diverging abutment surfaces, and each pair of converging recess surfaces is substantially ninety degrees (see Figure 7), an arrangement which minimises the wedging engagement of these surfaces. While the present invention is not necessarily limited to the use of an included angle of ninety degrees, said included angle must be such as to avoid any tendency for the contacting surfaces to wedge or jam. In the disclosed embodiment of the invention, see particularly Figure 7, the included angle of the upwardly diverging abutment surfaces 20 is slightly less than the included angle of the downwardly converging recess surfaces 26. As a result, only the lower portions of the abutment surfaces 20 and recess surfaces 26 are in contact with each other

when the containers are completely nested. This angular relationship of the abutment and recess surfaces serves to facilitate complete container nesting.

It is possible to invert the arrangement so that the radial lines of intersection, similar to the lines 22, 25, lie at the upper boundaries of the abutment surfaces 20 and recess surfaces 26. This involves a circumferential shift by one half pitch of the ribs 28, as seen in plan, relatively to the forms of the upper and lower sections of the stacking means, as seen in side elevation.

In Figures 1 to 8 inclusive the bottom section of the container 10 is identified by the numeral 30. In Figure 8*a* the bottom section 30 is positioned below the plane containing the bottom lines of intersection of the abutment surfaces 20. This construction serves to shield the lines of intersection 22 from damage in handling, and so preserve lateral strength.

In Figures 9 to 12 inclusive a container is designated generally by the numeral 10*a* and is provided with circumferentially disposed stacking means designated generally by the numeral 12*a*. A wall section 14*a* of the container 10*a* diverges generally upwardly and outwardly and a rim 16*a* is positioned immediately adjacent the upper margin of the stacking means 12*a*. The stacking means 12*a* is structurally identical with the previously described stacking means 12 but is located at the upper extremity of the container as distinguished from the stacking means 12 which is located at the lower extremity of the container. The structural details of the stacking means 12*a* corresponding with structural details of the previously described stacking means 12 are identified by similar numerals bearing the suffix *a*.

The stacking means 12 has an overall vertical extent indicated by the bracket 18*a* in Figures 9 and 10. The lower external portion of the stacking means 12*a* comprises a plurality of circumferentially distributed, generally triangularly shaped abutment surfaces 20*a* which diverge upwardly from bottom radial lines of intersection 22*a*, Figure 11.

The upper internal portion of the stacking means 12*a* comprises a plurality of pairs of generally triangularly shaped internal recess surfaces 26*a* which converge downwardly from lines 27*a* to lines 25*a* and extend radially inwardly from the inner surface of the sidewall portions 23. Pairs of the converging recess surfaces 26*a* define downwardly and radially extending recesses for interlockingly accommodating complementary pairs of external abutment surfaces 20*a* of a like container. The internal recess surfaces 26*a* extend inwardly from the inner surface of the container wall portion 23 and define a series of circumferentially positioned, radially extending recesses spaced upwardly from and between the external abutment surfaces 20*a*. When like containers 10*a* are in completely nested relation, the lower diverging abutment surfaces 20*a* of the upper container will interlock with the upper converging recess surfaces 26*a* of the container positioned therebeneath in the manner illustrated in Figures 5 and 7 relating to the previously described containers 10. It will be apparent from the foregoing that the only significant structural difference between the stacking means 12*a* of the containers 10*a* and the stacking means of the containers 10 is in the location thereof.

In Figures 13 and 14, a container is illustrated and identified generally by the numeral 10*b*. The only structural difference between the container 10*b* and the containers 10 and 10*a* is in the location of the stacking means designated by the numeral 12*b*. It will be seen that the stacking means 12*b* is located intermediate the upper and lower extremities of the container 10*b*. Thus, the bottom abutment surfaces of the stacking means 12*b* of an upper container will interlock with complementary upper recess surfaces of a like nested lower container in the manner herebefore described. The axial extent of the stacking means 12*b* is indicated by the bracket 18*b* and the rim at the upper extremity of the container wall 14*b* is indicated by the numeral 16*b*.

In Figures 15 and 16, a container designated generally by the numeral 10*c* is shown which includes a stacking means designated generally by the numeral 12*c* and disposed in the bottom of the container 10*c*. The container 10*c* comprises an upwardly flaring wall 14*c* and an upper rim 16*c*. The stacking means 12 is formed in the container wall 14 whereas the stacking means 12*c* formed in a bottom re-entrant section 30*c*. The stacking means 12*c* is structurally identical with the previously described stacking means 12, 12*a*, and 12*b* except that it is inverted and thus the previously described upwardly diverging abutment surfaces are downwardly diverging abutment surfaces and the previously described downward converging recess surfaces are upwardly converging recess surfaces. By having the stacking means 12*c* thus formed in the re-entrant bottom section 30*c*, said stacking means is somewhat shielded against damage which might otherwise result from inadvertent contact therewith and the outer sidewall of the container is undisturbed.

In Figures 17 and 18 a cover 10*d*, which

may be used as a "crimped-on" sealing cap for the upper extremity of the neck 32 of a bottle 34, is shown. It will be noted that the cover 10*d* is provided with stacking means 12*d* adjacent its closed extremity. The arrangement of abutment and recess surfaces forming the stacking means 12*d* is identical with the previously described arrangement of abutment surfaces of the container 10 except in reference to the upward and downward directions. This permits nesting of one cover within another as illustrated in Figure 17 to conserve space in storage and shipping of such covers prior to application. Extending axially beyond the stacking means 12*d* and forming a closure for one end of the cover 10*d* is a top section 30*d*. Each of the covers 10*d* includes a wall section 14*d* and the stacking means 12*d* is of relatively short axial extent as indicated by the bracket 18*d*. In instances where it is found desirable, the covers 10*d* may be formed of suitable material such as relatively thin metal. After one of the members 10*d* has been initially associated telescopically with the upper end of the bottleneck 32, it may be crimped into tight sealing engagement as clearly illustrated in Figure 18. Devices such as covers 10*d* may be compactly nested without the potential hazard of jamming in a manner similar to that described in connection with the containers 10, 10*a*, 10*b* and 10*c*.

It should be understood that the vertical extent of the stacking section may be varied to meet the needs incident to the use thereof. Also, the number, size and shape of the complementary abutment and recess surfaces may vary from the disclosure as herein described without departing from the scope of the present invention. The one piece containers 10, 10*b*, and 10*c* are so designed at to enable the economic production thereof by practicing available plastic molding and forming methods. The invention contemplates that the containers 10, 10*b* and 10*c* may also be formed of other materials such as metal foils, papers or composite materials.

WHAT WE CLAIM IS:—

1. A one-piece article capable of substantially surrounding an identical article in a nested relation which is determined by stacking means of each article, and in which the article is offset downwards along an axis relatively to the other article, the stacking means of the article comprising a first stacking section and a second stacking section, each section extending around the said axis, and the sections being spaced apart along the axis by the remainder of the stacking means, the first section comprising a continuous circumferential series of abutments, each defined by a converging pair of abutment surfaces oppositely inclined to the downward direction of the axis, and the second section comprising a continuous circumferential series of recesses each defined by a converging pair of recess surfaces oppositely inclined to the downward direction of the axis, the abutment surfaces and the recess surfaces forming respective complementary circumferential undulations, and the recesses being capable of making supporting engagement with the abutments of another, identical, article nested therewithin so as to maintain the articles free from binding engagement with each other when in nested relation.

2. An article according to Claim 1, comprising a bottom and a sidewall, both the sections of the stacking means being disposed along the sidewall, the lower stacking section being external of the article and comprising the abutments while the upper stacking section is internal of the article, and comprises the recesses.

3. An article according to Claim 2, in which the recesses extend radially inwards from the sidewall, and the outer peripheries of the abutments terminate within a circle having a diameter not in excess of, but approximating, the internal diameter of the sidewall at the bottom of the recesses.

4. An article according to Claim 3, in which the recesses are disposed adjacent to a free edge of the sidewall.

5. An article according to Claim 3, in which both the stacking sections are spaced from the free edge of the sidewall and from the junction of the sidewall and the bottom.

6. An article according to Claim 1, comprising a bottom and a sidewall, the bottom including a re-entrant portion, and the upper and lower stacking sections being in the re-entrant portion of the bottom.

7. An article according to any of Claims 2 to 6, in which, viewed, perpendicularly to the general plane of the bottom, the abutments are circumferentially offset relatively to the recesses.

8. An article according to Claim 7, in which each pair of abutment surfaces meets in a radial line, each pair of recess surfaces meets in a radial line, and adjacent pairs of recess surfaces meet in a radial guide line.

9. An article according to Claim 8, in which the part of the article connecting the upper and lower stacking sections is formed with alternate external and internal paraxial ribs, these ribs meeting, at lower and upper ends, the radial lines in which the abutment surfaces and recess surfaces meet respectively.

10. An article according to any of Claims 1 to 9, in which the abutment surfaces are

triangular, and the recess surfaces are trapezoidal.

11. An article according to any of Claims 1 to 10, which is a thin-walled plastics cup.

12. An article according to Claim 1, substantially as described with reference to Figures 1 to 8, Figure 8*a*, Figures 9 to 12, Figures 13 and 14, Figures 15 and 16, or Figures 17 and 18 of the accompanying drawings.

For the Applicants:—
GILL, JENNINGS & EVERY,
Chartered Patent Agents,
53 to 64 Chancery Lane,
London, WC2A 1HN.

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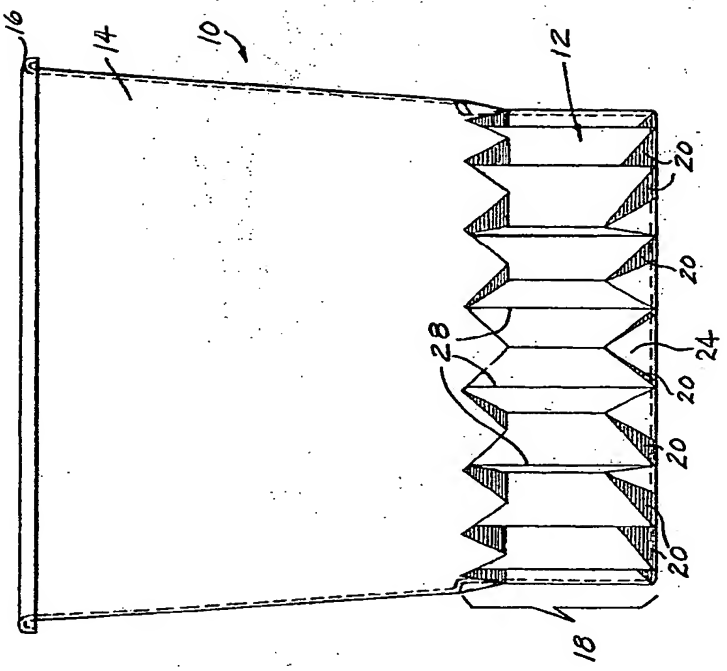

FIG. 1

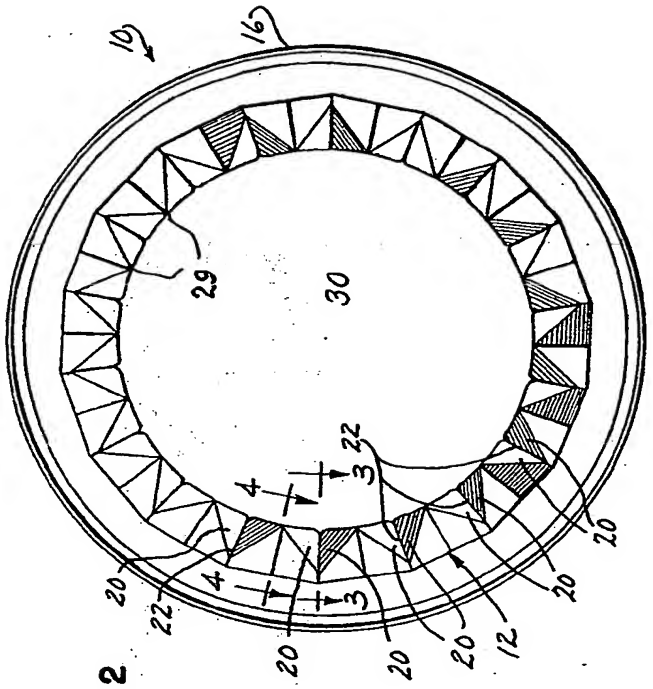

FIG. 2

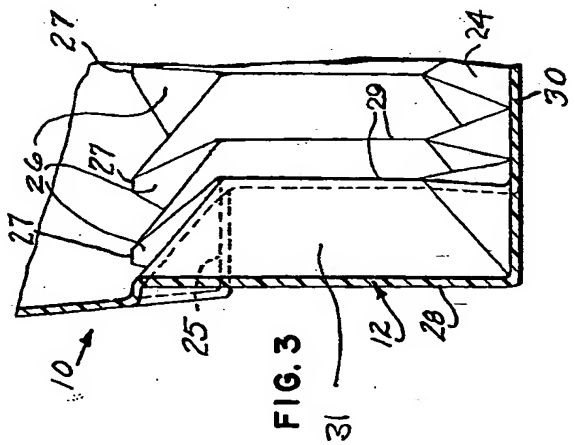

FIG. 3

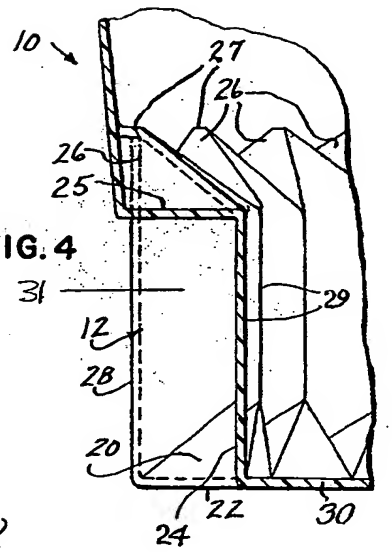

FIG. 4

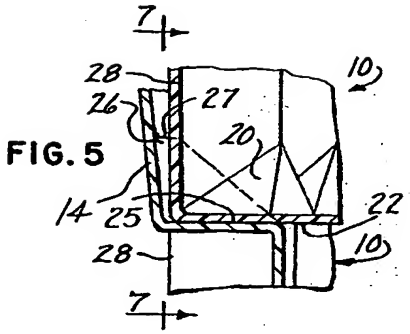

FIG. 5

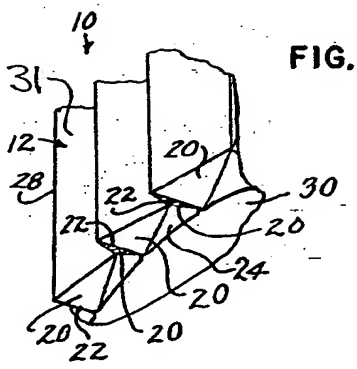

FIG. 6

FIG. 7

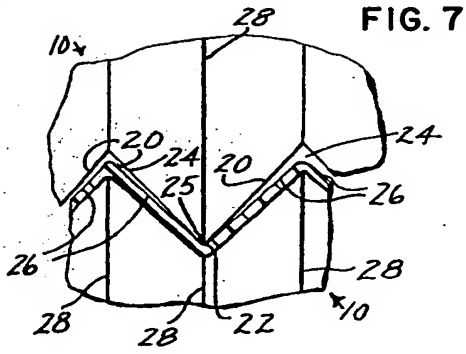

FIG. 8

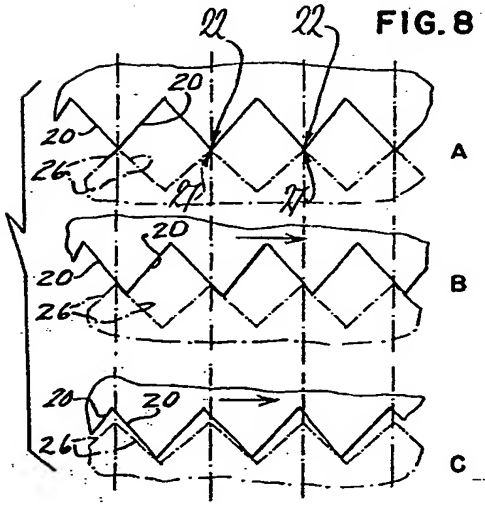

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Fig. 9.

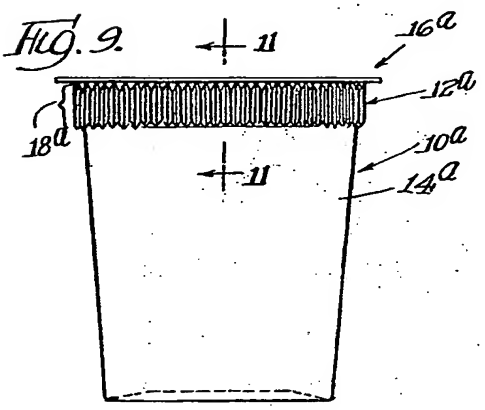


Fig. 10.

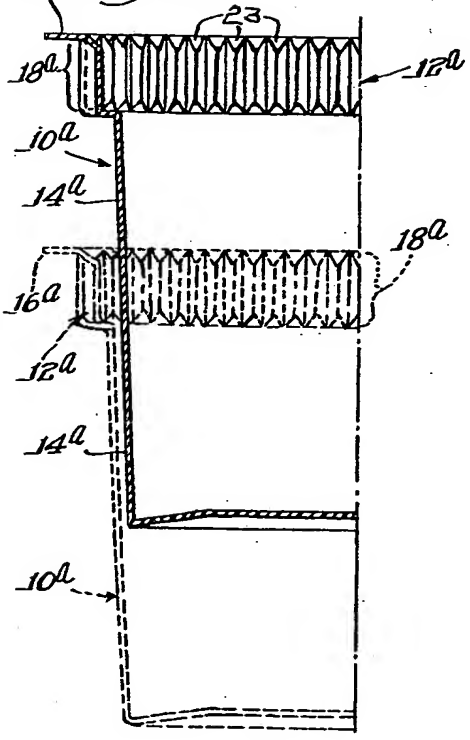
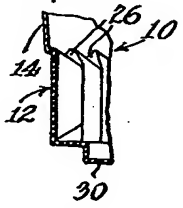


Fig. 8a



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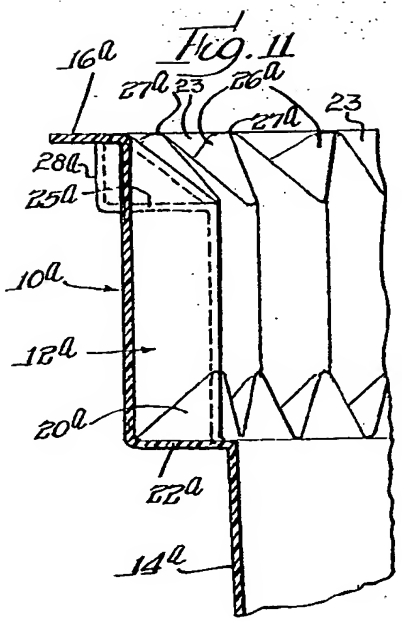
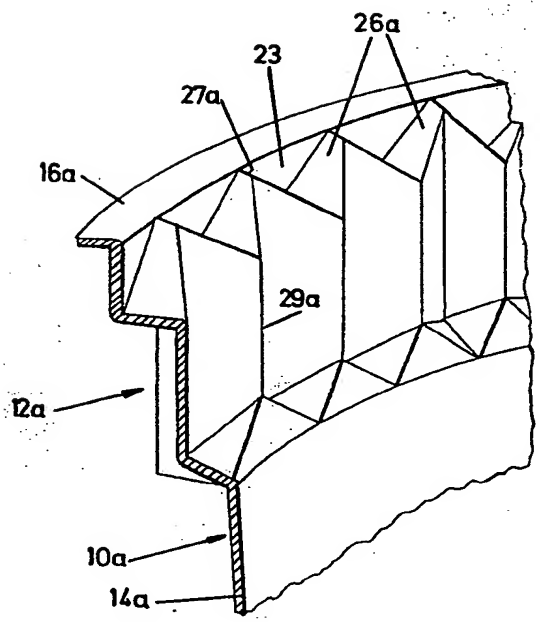


Fig. 11

FIG.12



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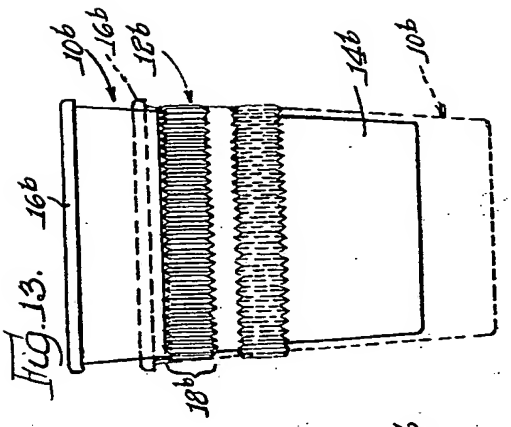

Fig. 13.

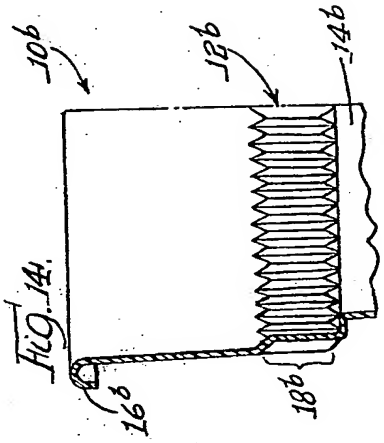

Fig. 14.

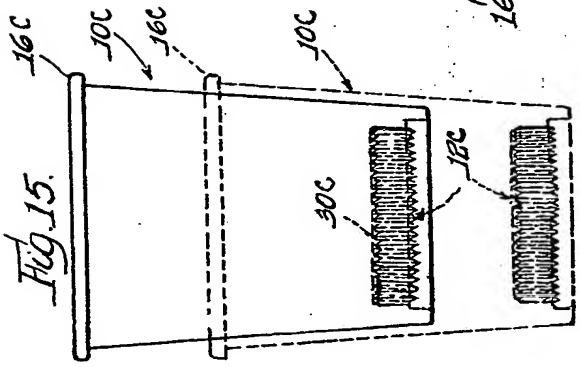

Fig. 15.

Fig. 16.

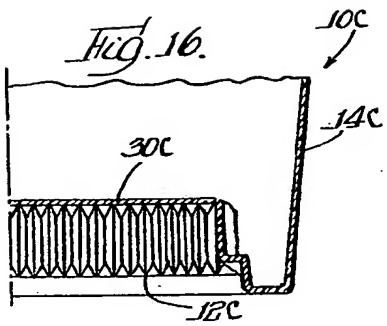

Fig. 17.

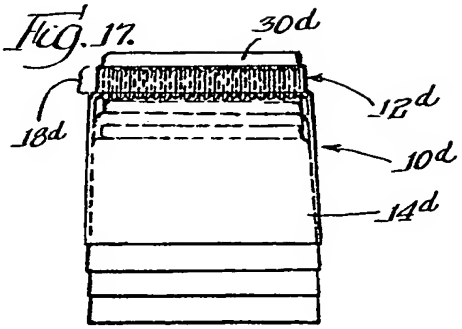

Fig. 18.